- *The dot plot keeps the original data about the 6 households. How does the location of the mean on the dot pot relate to the location of the individual dots?*
- *How does adding up the numbers and dividing by 6 relate to the cube stacks?*
- *For the two tables, the means are the same but the ranges are different. How is this possible?*

Note: The sets of data in this Problem are designed so that the mean will be a whole number. The cubes will all be the same height to indicate the mean. When you use more complicated data sets, the mean may involve a decimal or a fraction. When this happens, the cube stacks or value bars will have different heights.

Summarize

Suggested Questions

- *How does each model show the data before any evening out is done?*
- *How does each model show the data after the evening-out process is completed?*

Assignment Guide for Problem 2.1

Applications: 1–3 | Connections: 17–19

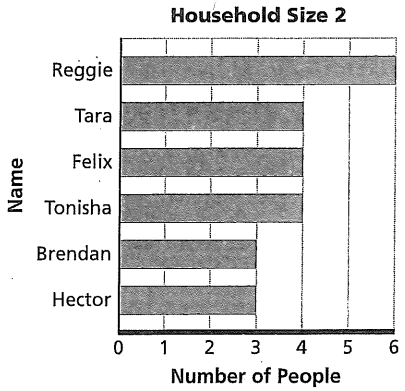
Answers to Problem 2.1

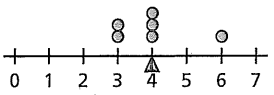
A. 1. Each dot on the dot plot represents an end point of the ordered-value bar graph. Since the bars are arranged horizontally, the ends of the bars line up with the locations of the values of the dots marking the size of the household on the dot-plot axis.

2. Answers will vary. There are several moves that will even out the bars.

3. Some students will physically move the cubes or use the ordered-value bar graphs; some may see that there are 24 people to share among 6 households/stacks. The final stacks/bars will have 4 people each.

B. 1.





2. The mean is 4. Some students will even out value bars. Some will build the data values with cubes and even these out. Some will use an algorithm.

3. The mean is the same for both distributions (4), but the median is larger for Table 2 (4, as opposed to $3\frac{1}{2}$).

4. Once you have all the bars evened out, you have 6 bars, each 4 "cubes" long, so the ends of the bars line up vertically above 4 on the axis.

5. You can say that an average or typical household size is 4. Some are greater than this, some are less; 4 is an estimate that is not far from any of the original values.

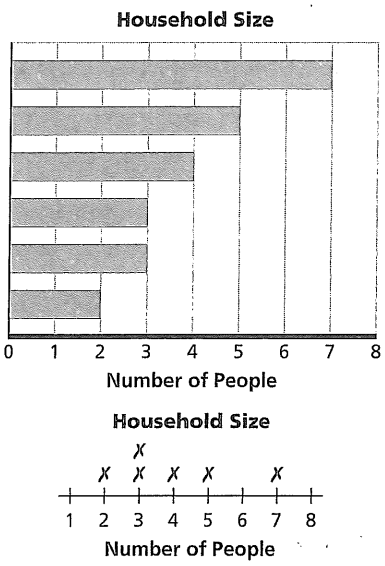
Assignment Guide for Problem 2.2

Applications: 4–7 | Connections: 20–25
Extensions: 33–34

Answers to Problem 2.2

A. **1.** Answers will vary. Possible example: 2, 3, 3, 4, 5, 7; sum is 24

2. Possible bar graph and line plot:



3. Answers will vary. Students may use the strategy of evening out.

4. **a.** Look at the length of the bar or at the data value below the ✗ on the axis.

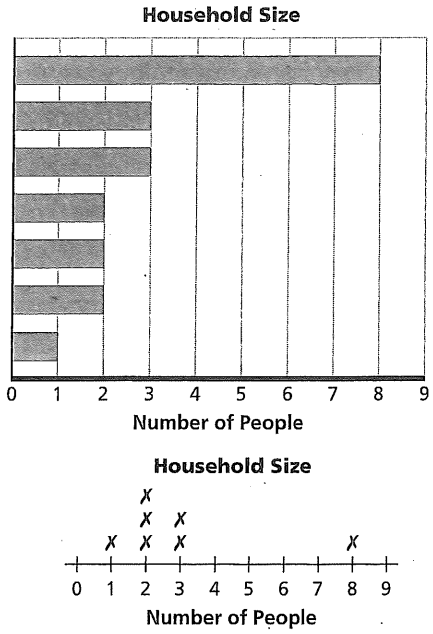
b. Count the total number of bars or ✗s.

c. Add up the lengths of all bars or add up all data values on the axis below each ✗.

d. Even out the bars in the ordered-value bar graph. For the line plot, you can move each data value toward a central value as long as the number of moves for the values above the central value is the same as the number of moves for the values below the central value.

B. **1.** Answers will vary. Possible example: 1, 2, 2, 2, 3, 3, 8; sum is 21

2. Possible bar graph and line plot:



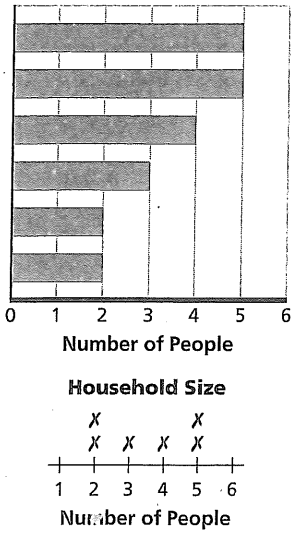
3. Answers will vary. Students may use the strategy of evening out.

4. Answers will vary. Students may imagine the cube scenario, rearranging household sizes so that the bar graphs and line plots spread out to the left and/or right of the original range.

5. See the answers to Question A, part (4).

C. **1.** Answers will vary. Possible example: 2, 2, 3, 4, 5, 5; sum is 21

2. Possible bar graph and line plot:



3. The mean does not have to be an actual or possible value from the data set.

D. 1. The median is 4 people, the mode is 4 people, and the range is 8 people.

2. Answers will vary. Guesses may be around 4–6 people.

3. The mean is 5 people. The mean is affected by the large households which have to be added into the total. Comparisons will vary based on estimates.

4. **a.** The median and mode are the same, the mean is not.

b. It is possible to have all three measures be the same or all three be different.

c. Answers may vary. At this point, students have not explored how to choose between using mean or median to describe what is typical.

E. Answers will vary. Most students will be ready to discuss the algorithm now. The mean is the number obtained by dividing the sum of all data values by the total number of data values. It is the value each data value would have if they were evened out.

ACE Assignment Guide for Problem 2.3

Applications: 8–9 | Connections: 26–27

Answers to Problem 2.3

A. **1.** Store B: mean = \$51.94, median = \$50; Store C: mean = \$64.61, median = \$50

2. The median is the same for each distribution, i.e. the midpoint of each ordered set of data is \$50 (for Store B, the ninth data value and for Store C, between the ninth and tenth data values). The means respond to extreme values; for Store C, a data value of \$200 affects the mean. Since there are no extreme data values for Store B, the mean and the median are close in value.

B. **1.** (See Figure 1.)

2. mean = \$48.50; median = \$50

3. **Store A's New Stock**

New Stock Price	New Mean	New Median
\$200	\$56.47	\$50
\$180	\$62.65	\$50
\$180	\$68.24	\$50
\$160	\$72.41	\$50
\$170	\$76.65	\$50
\$140	\$79.29	\$55
Question B, part (4): \$200	\$81.79	\$55

4. The mean would increase; the median would stay the same.

5. The mean will change with the addition of each data value. The median's position changes, but the value of the median may not change if there are repeated values; if the value of the median does change, it is not sensitive to the actual data value.

6. The median gives a better estimate of the typical prices of skateboards; students may want to add, "but there are some higher-priced skateboards, too."

C. **1.** Graph 1: Skateboard Prices From Stores A and B; Graph 2: Skateboard Prices From Stores C and D. Possible explanation: Graph 2 has to show data from stores C and D because it contains values greater than 120. Stores A and B have maximum values of 120.

2. When there are extreme values, the mean will be more easily affected.

D. The mean is strongly influenced by any extreme observations that are included in the data set. The median is resistant to any extreme observations that the data set may include.

E. **1.** Symmetric: mean = 5, median = 5; In the symmetric distribution, the two measures are (in this case) identical (in most cases, they are similar). The graph's values are balanced around the center.

Skewed-left: mean = 7, median = 8; The mean is less than the median. The long tail on the left shifts the mean to the left of the median. Both values, however, are higher overall.

Skewed-right: mean = 4, median = 3; The mean is greater than the median. The long tail on the right shifts the mean to the right of the median. Both values, however, are somewhat low.

2. Symmetric: the overall trend is in the middle: "It's okay." In the skewed-left distribution, the overall trend is a positive rating: "Thumbs Up." In the skewed-right distribution, the overall trend is a negative rating: "Thumbs Down." Because of the skewed graphs, it is probably best to report the median in all cases.

Figure 1